

#### **Discussion Points**

- Definitions
- Guiding Principles
- Strategic Monitoring
- Idealized Monitoring Framework
- Real Issues and Concerns
- Complicating Design Factors
- Useful Examples from NPS and Elsewhere
- Points to Emphasize
- Long-term Needs
- Questions Still to Address
- Current Plan
- Roles and Responsibilities

#### **For Clarification**

- Invasive species herein refers to all exotic (nonnative) plants, animals, and other taxa deliberately or accidentally introduced by humans. (NPS Management Policies 2001)
- Monitoring is the "collection and analysis of repeated observations or measurements to evaluate changes in condition and progress toward meeting a management objective." (Elzinga et al. 1998)
- A <u>protocol</u> is a *detailed plan* of a scientific experiment, treatment, or procedure. (Merriam-Webster 2004)

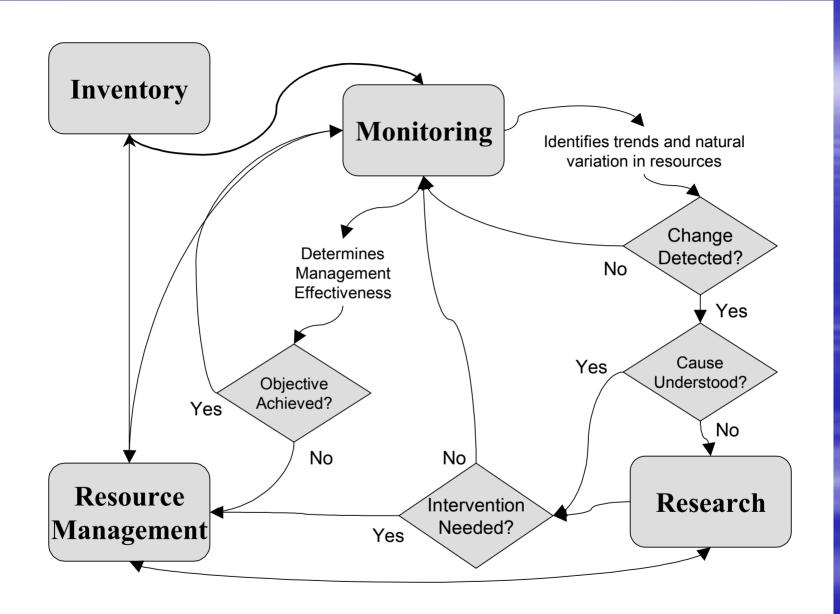
### **Guiding Principles**

- •Invasive species are a pervasive threat to natural resources and ecosystem integrity throughout the NPS.
- •Effective management of invasive species requires a <u>strategic</u> and <u>comprehensive</u> national program. (Detailed Action Plan for Nonnative species, 2000)
- •Invasive species management programs function at a variety of levels and involve individual park staffs, Inventory and Monitoring network staffs, Exotic Plant Management Teams (EPMTs), and regional and national technical support specialists representing all divisions.
- •Prevention is the most effective means of managing invasive species.
- •Effective and integrated invasive species management requires a well-developed inventory and monitoring program to ensure long-term success.
- •<u>Communication</u>, <u>cooperation</u>, and <u>collaboration</u> are essential to the success of any long-term management program.

# What's Required of a Strategic Invasive Species Monitoring Program?

Strategic approach (proactive)

- Well-defined goals and objectives
- Priorities, planning, actions, and expected outcomes.
- Consistency, collaboration, and coordination!
- Monitoring for prevention / early detection, status and trends, efficacy, effectiveness, and restoration.
- Database management.
- Monitoring, management, and research integration.



#### **Monitoring Components**

Prevention

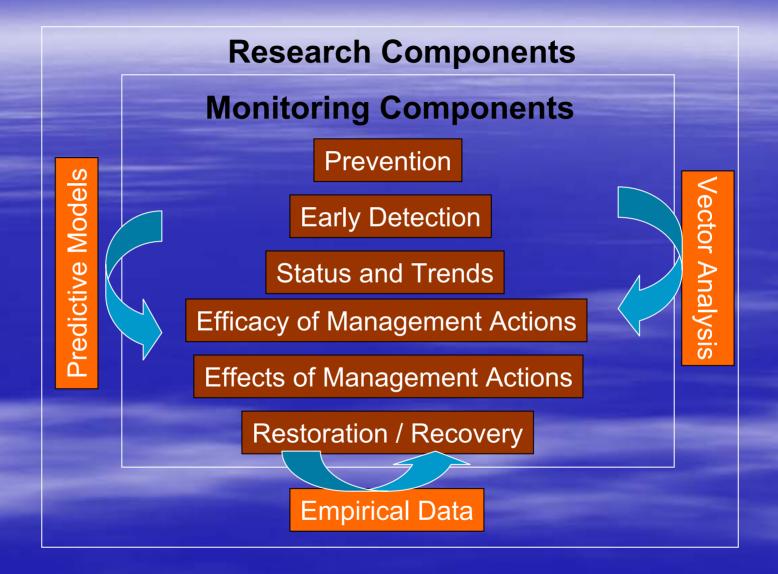
**Early Detection** 

Status and Trends

Efficacy of Management Actions

**Effects of Management Actions** 

Restoration / Recovery



**Management Components** 0 **Research Components Monitoring Components** Prevention redictive Models Vector Analysis **Early Detection** Interference Status and Trends **Efficacy of Management Actions Effects of Management Actions** Support Restoration / Recovery ecision **Empirical Data** Communication / Outreach

### **Key NPS Players**

- Parks
- •I&M Networks
- •EPMTs
- Regional Offices
- •CESUs/Universities
- •WASO
- •IPM Program
- Restoration Program
- Fire Program
- Vegetation Mapping
- Learning Centers
- Other Division Staffs as Necessary

#### **Real Issues and Concerns**

- Limited resources.
- Limited expertise.
- •Monitoring inconsistencies within and among groups.
- Lack of EPMT / Network coordination.
- Confusion over monitoring responsibilities.
- Prioritization schemes variable or non-existent.
- •Conflicting species priority lists (e.g., state, regional boundaries).

### Real Issues and Concerns (continued)

- •Focus on established weeds vs. prevention / early detection.
- Difficulty separating research from monitoring questions.
- •Integration of invasive species and community monitoring.
- Limited agency standards or direction.
- Inter-agency communication limited.
- Lack of available protocols for aquatic species.
- •NEPA compliance time consuming and expensive.

### Real Issues and Concerns (continued)

- No comprehensive list of NPS invasives research projects.
- •Remote sensing techniques expensive and limited application.
- Modeling techniques time-consuming and expensive.
- Predictive models lack complete empirical data sets.
- •Limited emphasis on predicting invasions, risk assessment, and restoration.
- Complexity of tracking infested and weed-free areas.

### **Complicating Design Factors**

- Scale (spatial and temporal)
- Data comparability
- Sampling intensity requirements
- Sampling frequency requirements
- •Monitoring purpose (e.g., efficacy, trends, early detection)
- Richness of invasive species
- Species autecology (e.g., dispersal, mobility, reproduction)
- Species distribution (e.g., clumped, uniform, individuals)
- Situation (e.g., roads, trails, wetlands, plains)
- Opportunistic vs. systematic or random design
- Park boundaries
- Impending treatment of monitoring sites

**Management Components** ols **Research Components** Early Detection ritoring Objective's

Status and Trends

of Mana **Monitoring Components** Vector Predictive Models Vector Analysis Interferenc Efficacy of Management Actions Effects of Management Actions Support Restoration / Recovery ecision **Empirical Data** Communication / Outreach

#### **Step Forward**

- •<u>I&M Invasive Species Workshop (2002)</u>—Initiated the coordination of invasive plant inventory and mapping across parks, networks, EPMTs, and other agencies.
  - •Recommended Measuring and Monitoring Plant Communities and guidelines for data collection and management (based on NAWMA and IMR).
  - Other guidelines and protocols suggested.

### **Useful NPS Examples**

Intermountain Region—Taking a proactive approach and attempting to coordinate monitoring efforts across the region. Developed more detailed data collection guidelines than NAWMA standards (Benjamin 2001).

Pacific West Region—Interested in coordinating a regional approach to invasive species monitoring.

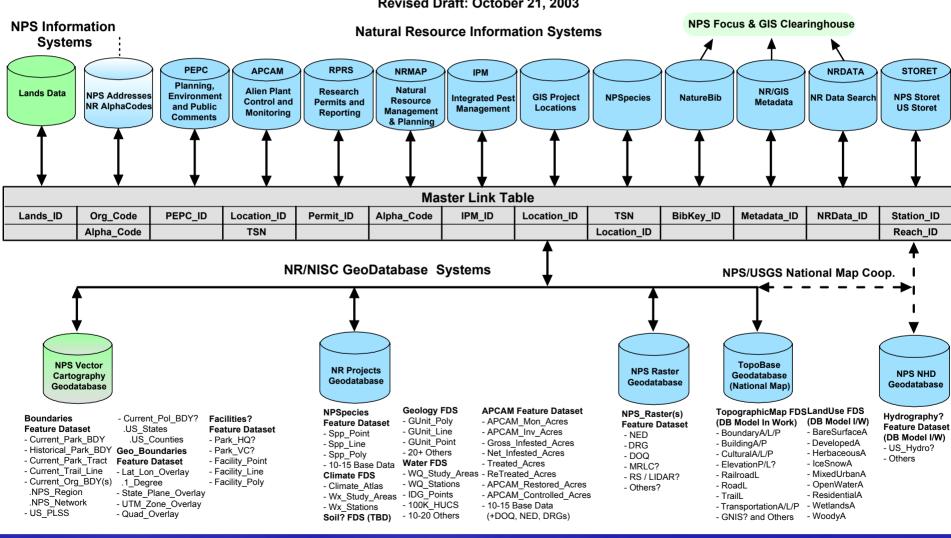
<u>National Capital Region</u>—Network and EPMT are discussing monitoring responsibilities.

- •<u>I&M Protocol Database</u>—Repository for peer-reviewed monitoring protocols.
- •<u>I&M NRDT</u>—Database template available for NPS programs to adapt for various monitoring needs. Buffet of fields and tables (BOFAT) being developed.
- •<u>Required/Optional Fields Crosswalk</u>—Developing list of comparable data fields from various invasives databases.
- •Great Smoky Mountains—GIS/Access database interface for all monitoring data.
- •<u>Hawaii Collaboration</u>—"The Squid," relational database connecting all species monitoring and treatment activities. Excellent example of stakeholder cooperation.

### NR GIS Database

### Relationships

Conceptual Diagram of Database Relationships with Select Natural Resource and NPS Information Systems Revised Draft: October 21, 2003



- •<u>Florida EPMT</u>—Working cooperatively with State of Florida to inventory, monitor, and manage invasive plants.
- Mid-Atlantic EPMT—Conducts statistically rigorous monitoring.
- •<u>California EPMT</u>—Developing own tracking and evaluation forms. Also interested in monitoring effects on non-target resources.
- •<u>Decision Support Tools</u>—Restoration rapid assessment tool (Benjamin 2003 and Hiebert 2003).

- •<u>Heartland Network</u>—Inventory and mapping protocol that can be adapted for monitoring. (After Prairie Cluster work and Thomas et al. 2002).
- •South Florida/Caribbean Network—Proposed project comparing application and effectiveness of several remote sensing techniques for invasive species monitoring.
- •Parks—Several using rotational monitoring programs.

Weed Sentry Program—Early detection and eradication cooperative program between NPS, Forest Service, SCA, USFWS, and local agencies. Identify, maps and treat incipient plant populations along roads and trails.

- •Golden Gate NRA—Ongoing volunteer program for mapping and monitoring invasive plants. Includes training manual, data sheets, identification flashcards, etc.
- Colorado NM—Adopt-a-Canyon and law enforcement input.

### What's Happening Elsewhere?

- •<u>USGS</u>—No standard protocols for invasives, but setting up a website repository for protocols and general guidelines (who, what, where, when). Protocols taxon-specific. Developing a corporate database.
- •The Nature Conservancy—No standard monitoring protocols, but has invasive species prioritization tool.
- •Environment Canada's Environmental Monitoring Network (EMAN)—Protocols for terrestrial invasive plants and other protocols that can be applied to other projects.
- •<u>Environmental Monitoring and Assessment Program (EPA)</u>— Excellent protocols for freshwater and estuarine aquatic indicators.

# What's Happening Elsewhere? (continued)

- •Forest Service—Taking a corporate, top-down approach. Has compiled and reviewed protocols from literature (Mike Ielmini). One standard database but <u>stored locally</u>. Protocols are taxon-specific. *Field Guide for Invasive Plant Inventory, Monitoring, and Mapping* available (Rita Beard). No single monitoring methodology.
- •<u>Forest Inventory and Analysis Program (USFS)</u>—Fixed hexagonal grid system across US that can be intensified. Designed to monitor timber production. <u>May not be useful</u> for invasive species monitoring.

# What's Happening Elsewhere? (continued)

- •<u>The Heinz Center</u>—Developing hierarchy of invasive species attributes from frequency to impact. Includes suggested monitoring methods.
- •National Institute of Invasive Species Science—Repository for invasive species maps and data. Includes Modified Whittaker Plot information (limited detection of species richness) and Forest Health Monitoring Plot information (statistically biased).
- •<u>FICMNEW</u>—National early detection and rapid response model.
- •Global Invasive Species Programme—Best prevention and management practices.

# What's Happening Elsewhere? (continued)

- •NAWMA—Recommends core data fields to collect for mapping and monitoring invasive plants.
- •Center for Invasive Plant Management—Guidelines for all aspects of invasive plant management, including prevention and forming a weed management association. No specific protocols currently.
- •BLM—Interagency technical references (*Measuring and Monitoring Plant Communities*, *Sampling Vegetation Attributes*). Developing an agency-wide database.
- •<u>USDA</u>, ARS—Aerial photography method using ultralight and GPS—1mm<sup>2</sup> resolution and relatively cheap.

### **Points to Emphasize**

- Monitoring objectives should include: indicator, location, attribute to be measured, management action, degree of change, time frame.
- Keep the end in mind (desired future condition).
- Know when to give in (upper infestation threshold).
- Include weed-free zones or sites of significance.
- Combine <u>opportunistic</u> and statistically rigorous programs.
- Think <u>incrementally</u> and <u>adaptively</u>.
- Foster <u>communication</u>.
- The degree of <u>integration</u> will vary across networks and regions.

#### **Long-term Needs**

- •Monitor weed-free and infested areas.
- •Consolidate Fire, I&M, and EPMT monitoring.
- •Find cost effective remote sensing techniques.
- •Utilize cost effective, validated predictive modeling.
- •<u>Improve monitoring</u> methods tailored to particular invasive species (particularly animals and pathogens) and systems.
- •Track relevant NPS invasive species research projects.
- •Fully utilize volunteer and opportunistic monitoring programs.
- •Share information and responsibilities across boundaries!

#### **Questions Still to Address**

- •Can we effectively apportion monitoring responsibilities across the different NPS programs?
- •At what scale should NPS <u>standardize protocols</u> and common <u>database elements</u>?
- •Should there be <u>specified protocols</u> for each monitoring type or simply a recommended list of peer-reviewed protocols?
- •How can NPS facilitate a move toward a more proactive [strategic] approach to invasive species monitoring?

#### **Current Plan**

- Straw document synthesis.
- Working group review and revision.
- Greater community review.
- Convene a workshop if necessary.
- •Research: input website or list serve.

# Monitoring Roles and Responsibilities

- Parks
- I&M
- EPMTs
- Fire Program
- IPM
- CESUs/Universities





### Discussion





